THE NEON NEWS

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FINE-TUNE, TURN ON, DON'T DROP

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"DEADLY NEON":
A lethal dose of art criticism

***Editors' note:** Joe Augusta teaches an art-oriented glass-bending class at UCLA, and was one of the last graduates of the Egani neon school in New York. In a recent phone call we discussed teaching design vs. actual bending, and Joe was emphatic about the problems students have had getting past stereotypes and trite images, especially in the classes he formerly taught where students only designed and didn't bend glass. The accompanying list is part of a handout he gives to students on the first day of class. Judging by the number of palm trees, flamingos and cactuses out there, we should have a nice pile of flak mail to pass on to him.*

By Joe Augusta

Here's my verboten list from my class at UCLA. The usual response from the students is a blank stare, then "Well, what's left?" That's where the teaching begins: getting the students to let go of their preconceptions regarding neon, their bag of cliches they bring to the class.

I won't let them make it (whatever it is) bigger, a different color, a slight variation, etc.; they have to think for themselves and come up with something on their own.

I mean, if at the core of your uniqueness as a human being is a cactus, get out of my class!

Palm trees, rainbows, lips, coat hangers, flowers, bicycles, shoes, hats, shirts, pipes and cigars, cigarettes, cameras.

Parrots, flamingos, all birds, fish, crabs, lobsters, cows and horses.

Unicorns, rabbits, dragons, camels, whales, frogs, sharks and mice; all cats and dogs.

Coffee cups, cocktail glasses, eyeglasses, teeth, ears, hearts.

Wine bottles, pizza, spaghetti, bread, hot dogs, hamburgers, steaming chicken.

Circles, triangles, squares, any geometric shape complete or incomplete.

Stars, shooting stars, moons, planets and bubbles, sun and clouds, waves, and lightning.

Planes, trains, cars and boats.

Guitars, electric bass, acoustic bass, trumpets, saxophones, and pianos.

Chairs, beds, tables, desks and light bulbs.

Barns, skyscrapers, cityscapes, houses and Greek columns.

Teaching neon as a design class alone is even worse.

First off, students should take historical classes in design (they don't), then they should learn design with simple items they're familiar with: they should learn how to use a pencil.

They should study the history of neon signs and sculpture; they should study art, and be relatively comfortable making art; they should have made art in any medium at some time

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Remember: what you see, think and feel can be expressed in neon. But the medium has pitfalls and traps that can lead to a terminal case of banality. Unfortunately, we carry these things about in our heads, and they will stop us from finding our own voice! Therefore, they are to be avoided at all cost, and will be prohibited from this class.

More hot leads and cool sources

As more and more catalogs and referrals are passed our way, this "unusual sources" listing looks like it's becoming a regular feature. An anonymous bender sent a whole catalogue of high frequency testers, and wrote:

"When I ordered my spark coil from the local sign supply house, they had to back-order it. As a result, it arrived factory direct, along with a product booklet and price sheet.

"I worked in a shop that used model BD-20 to test manifold vacuum, and it will not damage glass stopcocks or welds and it will not crack thick/thin glass."

The company is **Electro-Technic Products**, 4642 N. Ravenwood Ave., Chicago, IL, 60640, (312) 561-2349. These people make the standard-type test coil seen in most shops—what's interesting is the unusual models such as BD-20 mentioned above, which "generates a high frequency spark which is softer. Used for testing delicate glass objects under vacuum. The spring electrode tip minimizes damage to these surfaces."

Also notable are the unusual insert tips such as model #1250, a $28 quartz tip "designed to ionize the fluorescent powder in glass tubing used for lamps and signs, to determine its color, and for sorting glass before making the glass into tubes" — a cheap color-checker, in other words.

The general array of information and instructions concerning the high-frequency apparatus might make it worth your while to write them for information; we recieved 10 photocopied pages, including price lists.

Charles Steele always has interesting stuff, and a recent letter from him lists a $32 temperature guage, heat-shrink tubing for GTO/electrode connections, unusual electrode receptacles, and some cheap-but-handy things like capped 49" tubes for glass storage and paint-can drip lids for blockout paint. Write him at 2615 Hauser Blvd., Los Angeles, CA 90016, (213) 933-5464.

He adds "I have information on RF units, small tankless blowers, opaque projectors and muffin fans for spot cooling. Anyone could contact me regarding these useful items."

Jed Schleisner of Kaaawa, Hawaii, gave me two catalogue recommendations:

KEY High Vacuum Products Inc.
36 Southern Blvd.
Nesconset, NY 11767
(516) 360-3970
(He said they have KF-type manifold components at lower prices than HPS)

Edwards USA Vacuum Equipment
Wilmington, MA
(800) 848-9800
(Ask for a catalogue and a price list)

And in case anyone else was wondering about the new HPS ads in Signs of the Times that say their 917 pirani guage can be used for backfilling neon:

I wrote them, asking what was up, since the neon pressure makes the needle go off the scale. They wrote back explaining that the guage now has a new face, which extends into the filling range for neon gas.

We'd be curious to know if anyone else is experiencing sensor tube failure with these units — our second unit has gone dead now, without any "sudden pressurizing" accompanying it.

HPS states that with neon manifold use there needs to be a grounded KF-type fitting with a centering screen, to prevent flashback, but with this all in place ours still went dead, and their response so far has been to shrug and say "we'd like to consider ours to be one of the most rugged in the industry." Grrr.

Friends, roamers and countrymen,

Aloha again from Minnesota, where we are still working odd jobs and waiting for the kid. Ted is restoring a theater marquee, and Val has stolen some time from her newspaper job to rifle through historical libraries and permit offices to research what that theater looked like before 40 years of bad renovations. So you will see more on this in the next issue.

Maybe we should have called this "the gripe issue," what with Joe Augusta attacking cliche art neon, Nancy Hannmann taking on dangerously sloppy wiring, Val railing against fake "neon" and Audie Foote (AKA "Neon by the Foote") assailing installers. Audie at least offers a classic junkie's excuse, blaming the venom and length of his complaint on strong Kona coffee.

Many of you will notice a letter tucked into this issue begging you to resubscribe to The Neon News; others can expect similar letters as your subs run out. You can save us time, postage and paper, and avoid missing an issue, if you send us your answer soon. We won't mail reminders or automatically extend your sub, because we can't afford to.

And please fill in the questionaire along with your order. If you refer us to potential subscribers, we will send them a free issue; if they subscribe, we will extend YOUR subscription by a free issue too (this is the best we can do in the face of rampant Xerox piracy). Also, we need you to tell us if we should expand this operation to six issues a year, since Val wants to—we certainly have enough material, etc.—and Ted most certainly DOESN'T want to.

Keep in touch,

Ted + Val

The Neon News is published quarterly by Val Crawford and Ted Pirsig, P.O. Box 668, Volcano, Hawaii, 96785. (808) 967-7648. Subscriptions are $15/year. No advertising (other than classifieds, at $.25 per word) is accepted.

The Neon News welcomes stories, artwork, ideas, letters, suggestions, irate comments and anything else you can think of. The editors make no pretense to be experts in the field; the newsletter is intended as a forum where neon folks can exchange ideas and information.

In the hot seat:
Testifying in court over a wiring fire

An interview with Nancy Hannmann

Editor's note: Nancy Hannmann is the owner of Neonically Speaking, a neon shop in Albany, NY, and has she been a telephone and writing correspondent with the Neon News editors since the newsletter's inception. The following story came up in the course of a telephone call, and we thought it raised enough legal and ethical issues to ask her permission to use her account.

I've been called a couple times to be an expert witness on fires. Restaurant fires, when it started on the neon, and things like that.

This one particular restaurant ... had a fire. They called me up for <interior> neon to begin with, and before that ... they'd just gotten this border tube in, and it was an old sheet metal <exterior> — like a Silver City type of diner, you know what I'm talking about? Art deco — they're re-doing the whole thing to be this nice little cool place, this great restaurant.

So anyway they call me down, to do some other neon. I'm walking down — this literally happened right in front of me — I'm walking down the sidewalk, and I hear this massive arcing buzz, which is only from neon transformers.

"They used used tube supports, that's how bad it was. They used ACME transformers that they had painted over. ACME's been out of business for 30 years!"

I start walking faster and faster and I get to the building and the corner of it is on fire, where the bare copper tie wire in the "spaghetti" glass <5mm> had broken, and had arced to the building, and the leaves in the gutter had all started on fire. And it's still on, so it's still arcing, and the fire's getting bigger, it's on the corner of the building. It wasn't really bad, but it was getting bad.

So I ran right in the building through the back door, ran down the stairs — I didn't tell anybody. This is like 5:30 in the afternoon, the place is jammin', and I threw the main breaker.

I did that because I couldn't find <the sign fuse> — it was so bad, the fuse box was so bad, nothing was labeled at all. And I had to move about ten cases of Heineken out of the way — ridiculous. So I threw them on the floor, they're banging and crashing and rolling everywhere, and I threw the main, just pulled it right down.

Threw it, right, and everybody is just screaming upstairs. I try and find Jimmy, I'm yelling at him going "You gotta call the fire department" — and then everybody just died. I mean, you know, "call the fire—," I was trying to keep it low. Then somebody yelled FIRE and everybody runs. Out the door they all go.

And the fire's outside. So once they see the fire's outside, then they run in the other direction.

Now, the fire is still going. The leaves are still burning, as well as the top of the building. Now it's starting to go up, you know. It still wasn't really that bad. It didn't go really deep into it — it's really pretty much a surface fire, and I knew that. I'm a fireman too; I'm pretty familiar with fires. The fire department came, they just used a little CO_2 tank, put it out; it wasn't a big deal.

Still and all, I told the owner, "This whole job is a piece of shit." They said "Fix it." I said "I won't fix it. I won't touch this. I'll get sued. I don't want to touch it." There wasn't a piece of high-tension (GTO) on the whole thing...

Neon News: You mean it was all just bare wire connecting one to the next?

Yeah, in tubulation glass. It was just a border, double row of border, 15mm blue, you know, outside border tube, nothing major. It was an easy job. They used used tube supports, that's how bad it was. They used ACME transformers that they had painted over. ACME's been out of business for 30 years!

NN: Was this in Albany?

Yeah, right in Albany. And the transformer boxes, they didn't even have covers on them, so they had accumulated water bad. They're half-full with water. So I go up on the roof — this is the first time that I'd been up on the roof to really look at the job — I mean, I knew it was a shitty job anyway but I didn't really realize the extent of how badly they had gotten ripped off...

So I told the owner, "Jim. Sue 'em. This is crap. This is why there's no neon allowed in Albany. It's shit like this that makes it hard for the rest of us to do a good job, or do it at all." So he said "Okay," because he had just paid 'em, I think he paid them something like $2500 for this double border. So I said "I'll be an expert witness for ya."

So I get up there with a camera, and I stick the old wooden yardstick in the transformer box to show how far the water came up...

NN: How far up was it?

It was seven inches. It was almost covering it. It was incredible. How it even worked — I couldn't believe it. And you could see the paint, the paint lines where they had painted the transformer over and left a sticker on there. I couldn't believe when I saw "Acme Transformer." I thought, my god, it's an antique, they'd probably get more for it as an antique than they can as a transformer.

All the tubulation they'd used to connect — literally, they ran it from the transformer to the neon, which was probably eight, ten feet — it was all in spaghetti glass. I don't know why they did that. It just all broke, you know, from the first bad storm. That stuff doesn't take much. So it's all broken and

(see Hot seat, page 10)

Pumps: Better living through emptiness

Editor's note: Mark Snyder writes to us from Precision Neon Laboratories, West Columbia, SC, (803) 794-5974. Excerpts from their catalog and his article on aspirator vs. diffusion pumps were featured in our last issue. The company sells high-tech manifold equipment, such as greaseless stopcocks and glass diffusion pumps.

We will generally publish anything from anyone if it's good, pertinent writing that explains something well, so don't assume we are corrupt or the happy owners of any company's goods. We do want to make clear our authors' biases, so you can cross-check and draw your own conclusions. Personally, I've been very curious about secondary pumps, and so I find this article pretty lucid and most welcome. If any of the tech terms stump you, see Mark's glossary on page 7.

By Mark A. Snyder

There is a great deal of controversy about whether a secondary vacuum pump is needed to process neon tubes, and what kind.

To answer this question, one must first understand the capabilities and limitations of mechanical fore pumps, better known in the scientific industry as "roughing pumps."

The roughing pump was designed for just that: rough pumping. It is not intended to produce high vacuums on a cycling basis after repeated exposures to atmosphere. It is meant to create a rough vacuum in the work chamber — in this case, the manifold and neon unit being processed.

The argument arises, "I have a two-stage vacuum pump that pumps 100 liters per minute with a guaranteed vacuum of 10^{-4} torr (0.1 micron). I don't need a secondary vacuum pump." It is usually unknown as to how these performance figures are arrived at, and what they mean under actual working conditions.

Generally speaking, guaranteed vacuum or ultimate vacuum of a mechanical pump is arrived at by attaching the guage-tube of a vacuum guage directly to the intake port on a new pump, and allowing the pump to run non-stop for a 24-hour period under "controlled" surroundings with no load on the pump other than the guage tube. A reading is then taken from the vacuum guage to determine ultimate vacuum.

As load is added to the pump, such as tubing leading to the manifold, the manifold itself and all of its stopcocks, the ultimate vacuum rapidly diminishes and may not even reach 10^{-2} TORR (10 microns).

The pumping rate, in this case 100 L/minute, is "free air displacement," which means the intake port of the pump is wide open to atmosphere and can pump through it 100 L/minute and exhaust 100 L/minute. The same pump when operated under hard vacuum will not pump 100 L/minute. In fact, at a reduced pressure of 10 microns (not good enough for neon production) and under adverse conditions such as pumping neon units, this pump may only be capable of pumping 20 or 30 liters per minute or less. This may sound like a lot, but in fact it is not, as you will see later on.

Pump oil. Perhaps the most important factor in determining the ultimate vacuum of the roughing pump at any given time is the condition of the pump oil.

Consider what you are pumping and pulling into the pump oil. The majority of what is pumped out of a neon unit (>90%) is water vapor. The water vapor is pumped through the oil but is not entirely exhausted to atmosphere, nor are other impure gases and vapors which remain in the oil.

Because the pump is sealed by oil internally and achieves its vacuum this way, the best vacuum obtainable is determined by the vapor pressure of the oil. If the oil is contaminated and saturated with water and other impurities, its vapor pressure is drastically increased, making it impossible to achieve a good vacuum.

The more units that are pumped, the worse the problem gets. This explains why the performance of a new pump may seem to drop off after a few months. It also explains why people often say fore pumps have trouble pumping moisture.

In addition, the contaminated oil vapor can backstream into the manifold and literally be "pushed" into the unit while filling with rare gas, making the unit even worse. Short of changing the oil every other day, an alternative means of consistantly producing a high vacuum has to be used. Hence, secondary vacuum pumps...

Secondary vacuum pumps are intended to compliment roughing pumps, allowing much lower vacuums to be achieved in shorter periods of time. There are many types of secondary vacuum pumps. Diffusion, turbomolecular, cryo, ion and titanium sublimation pumps are some of the secondary vacuum pumps used in various industries today. They all require a mechanical roughing pump to operate. None of them can, or are intended to operate at atmospheric pressure. Rather, they operate at reduced pressures of a few millitorr (microns) and below.

Of all the secondary vacuum pumps available there are only two which can be considered for neon tube production due to the contaminated conditions that neon tube evacuation presents to the secondary pump. These are the turbomolecular pump and the diffusion pump.

Turbomolecular pumps are all basically the same, with the exception of size. They range in size (pumping speed) from about 50 liters/second to over 9,000 liters/second and are designed to operate at pressures of 10^{-2} torr (10 microns) and below.

The turbo pump operates on the principle of transferring the momentum of a high-speed rotating blade (turbine) to a gas molecule. The turbo pump is a series of angled rotating blades, usually ten to fifteen sets of blades. Between each rotating blade is a fixed blade with its blade-angle opposite that of the rotating blade. The rotating blades are turning at speeds up to 75,000 rpm. Under molecular flow conditions a gas molecule randomly enters the pump and is impacted by the first rotating blade. The momentum of the rotating blade pushes it on to the next blade, and so forth until it is finally exhausted to the roughing pump.

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(Snyder, from previous page)

Due to the extremely high rotational speeds only the highest-quality precision bearings can be used. Sudden air in-rush while operating, such as at the beginning of a pumping cycle, will have an adverse effect on bearing life. In addition, if glass fragments, mercury or other debris should enter the pump at operating speeds, the result would be catostrophic for the pump.

Turbo pumps range in price from $3,000 to over $50,000, so they can also be detrimental to your bank account. In short, it is questionable as to the long-term usefulness of the turbo pump for neon tube production, based on its fragile nature.

Diffusion pumps come in a variety of shapes and sizes, and in metal or glass. Metal diffusion pumps generally are three-stage pumps and are liquid-cooled, although air-cooled pumps are available. Metal diffusion pumps range in size (pumping speed) from about 150 liters/second to over 60,000 liters/second and are designed to operate at pressures of about 100 microns to 10^{-11} torr (0.00000001 micron). One big advantage of diffusion pumps is that they have no moving parts. With resonable care they will last indefinately.

The diffusion pump operates on the principle of transferring the momentum of a high-velocity, heavy-molecular-weight oil vapor to the gas molecules being pumped out of the work chamber, in this case the manifold. The pump has an oil resevoir (boiler) that contains a specified amount of special oil having an extremely low vapor pressure. Today's oils are synthetic and are usually silicone base. The oil is heated under vacuum to the boiling point, although no visible boiling is evident. If the pump were not under vacuum the oil would not vaporize and no pumping action would occur. The oil vapor exits the pump's jet assemblies at supersonic speeds, impacting gas molecules and forcing them on to the exhaust port.

Most three-stage metal diffusion pumps require some type of cold trap to prevent backstreaming of the oil vapor, because they usually operate below 10^{-7} torr. Pumps operating above 10^{-7} generally do not need cold traps, as backstreaming typically occurs between 5×10^{-7} and 10^{-7} torr. In neon production, where pressures seldom go below 10^{-4} torr, backstreaming is not a problem unless the oil is heated excessively and actual boiling occurs.

As with any vacuum apparatus, metal diffusion pumps need to be cleaned and maintained periodically. Disassembly of the pump and cleaning accumulated contaminants from metal parts is essential to provide high-vacuum performance. Even the assembly of the pump requires wearing gloves, to insure that body oils do not come in contact with internal parts (which could cause oxidation of the metal). Body oils in themselves outgas tremendously when under high vacuum, and this sometimes requires several days to accomplish.

In addition, jet assembly clearances are extremely critical and should be performed by a qualified technician. After cleaning and assembly these pumps require a minimum of 24 hours under high vacuum to de-gas internal parts. In short, metal diffusion pumps are not necessary or desirable for neon production.

Glass diffusion pumps (not aspirators) are available in different sizes and styles, but generally are one-, two- or three-stage pumps, air-cooled or liquid-cooled. Three-stage pumps usually have pumping speeds of 30 liters/second with ultimate vacuums of 10^{-8} torr or better and are full fractioning pumps. With this in mind they should be used in conjunction with a cold trap to prevent backstreaming of the oil vapor.

Vacuum systems will maintain a higher level of performance if they are allowed to be on and pumping continously around the clock.

Two-stage pumps have pumping speeds between 11 liters/second and 26 liters/second depending upon design, with ultimate vacuum between 10^{-6} and 10^{-7} torr or better, and are also full fractionating pumps. Again, with pumps operating at these vacuums cold traps should be used.

Although the two- and three-glass pumps have considerably lower pumping speeds than the metal pumps, they are still more than what is necessary for neon or even cold-cathode production.

Single-stage pumps have a maximum pumping speed of 10 liters/second at an ultimate vacuum of 10^{-5} torr or better, and are semi-fractionating pumps. With this in mind, these pumps do not require cold traps because the ultimate vacuums obtained do not promote backstreaming of the oil vapor.

The ideal pump. Contrary to popular criticism, the single-stage oil diffusion pump, when used with the proper size roughing pump, is the ideal choice for neon and cold-cathode production. When operated at the correct boiler temperatures and using proper silicone fluids they require very little maintenance. They have no moving parts to wear out, and with the use of silicone oils have a high resistance to oxidation of the oil.

Although its pumping speed seems small compared to metal pumps or even two- and three-stage glass pumps, the maximum speed of 10 liters/second equates into 600 liters per minute, which is far more than most roughing pumps used for neon can handle, so maximum performance of the pump is seldom achieved.

Glass pumps are one-piece construction. Cleaning requires simply rinsing the pump out with a suitable solvent and a final rinse with analytical reagent acetone. Exceptionally dirty pumps can be soaked in solvents without fear of damage, or run through an annealing oven to burn off contaminants.

One concern with using diffusion pumps in conjunction with high voltage is the theoretical possibility of combustion within the pump. If petroleum-base stopcock grease is allowed into the pump it will vaporize to some degree due to the high temperatures of the boiler and pump fluid. Add to this a bombarder flashback through the manifold and pump, and

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you have the makings of an internal combustion engine: petroleum vapor with enough voltage to ignite it! Needless to say, grease and other oils should not be allowed into the pump. If this happens the pump should be cleaned as soon as possible. The use of greaseless stopcocks helps eliminate this potential hazard. If bombarder flashback occurs, the reason for it should be found and the problem solved. Not only can flashback damage diffusion pumps but also turbomolecular pumps, as they are electrically controlled. In addition, the flashback can crack stopcocks and damage other glass manifold components.

Pumping speeds. Looking again at pumping speeds, in particular the 100 liter/minute roughing pump that at reduced pressure can only pump 30 liters/minute: this equates into only 1/2 liter/second. When you consider that a coated tube, 15mm in diameter and ten feet long, when heated to 200° C will release several liters/second of gas load into the tube, it becomes readily apparent that the 1/2 liter/second roughing pump is not adequate if you want to achieve high vacuum before the tube cools off.

Generally speaking, any gasses remaining in the tube after it cools off below 175° will be absorbed by the powder coating as it cools, and will remain in the tube. They will then be slowly released into the tube during operation, due to outgassing and de-gassing under partial vacuum, and will become chemically active with the mercury vapor and cause darkening. In the case of red tubes excessive release of gasses during operation can cause the unit to go dead. Therefore it is essential that after bombarding is complete, the vacuum in the tube should be below 10 microns before the tube has cooled to 175° , and below 5 microns before it cools to 150°. Mechanical roughing pumps cannot achieve this alone. Therefore it is necessary to use a secondary vacuum pump to obtain these desired results.

Manifold construction. One of the most important considerations when installing a secondary vacuum pump is the system it will be pumping. Secondary pumps will not pump any better than the system that they are attached to will allow. Manifolds should be constructed using the largest diameter and the shortest length of tubing practicable. Generally speaking, 20mm to 25mm tubing no more than 30 inches long should be used for the main leg of the manifold, with a 10mm or larger main stopcock. Under molecular flow conditions, smaller-diameter tubing restricts the random free-flight migration of gas molecules into the secondary pump, and thus never allows the pump to reach its ultimate vacuum. Under viscous flow conditions (rough pumping), small-diameter tubing does not allow fast enough (before the glass cools off) volume transfer through itself for the pressure inside the manifold to enter into molecular flow conditions.

To prove a point, if you have to pour five gallons of water through a pipe it will go through a two-inch pipe faster than a one-inch pipe. By the same token, if you have one drop of water it has less chance of hitting the wall of the two-inch pipe than the one-inch pipe, before making it through.

Roughing pump oil. Diffusion pumps are compression pumps. They take a relatively small volume (low pressure) at the intake and move it on to the exhaust and compress it to a larger volume (higher pressure) so the roughing pump can pump it to atmosphere. The condition of the oil in the roughing pump is relatively unimportant to the diffusion pump, so long as the necessary priming vacuum for the diffusion pump is provided. This priming vacuum is usually 40 to 50 microns for single-stage pumps.

Backstreaming of contaminated oil vapor from the roughing pump will only travel as far as the exhaust port on the diffusion pump, due to the high-velocity oil vapor from the diffusion pump constantly forcing pumped gases toward the exhaust port. This in turn provides a clean environment on the manifold (neon) side of the pump, and consequently the neon units being processed.

On all the time. Finally, vacuum systems will maintain a higher level of performance if they are allowed to be on and pumping continuously around the clock. In reference to the roughing pump under these conditions, any good mechanical engineer will tell you that with this type of mechanical equipment approximately 80% of the wear on internal parts occurs during cold start-up. Allowing the pump to get hot and cold (starting and stopping) in itself contributes to the amount of water vapor in the oil due to condensation.

The diffusion pump, if allowed to be on continously, will keep its pump body de-gassed and its oil outgassed. In addition, it will maintain a high level of vacuum in the manifold system which in turn will keep the system outgassed.

During the pumping schedule throughout the day the manifold will retain a certain amount of the contaminant gases that are being pumped through it. Merely shutting the system off at the end of the day will allow these gases to remain in the system and accumulate rather quickly. If the entire system is allowed to pump through the night it will be outgassed by the next morning from the previous day's work. Outgassing takes time and should not be rushed or expected to happen in a matter of a few minutes. Rather it will take several hours to be effective.

Due to the nature of the work load, neon pumping systems never obtain 100% outgassing after having been used for only a short time. Therefore, the longer the system is allowed to pump with no work load, the more outgassing that will be accomplished and the higher the performance that will be realized when pumping is again performed.

Even when not in use, the diffusion pump should be at operating temperature and under hard vacuum so maximum fractionation can occur and allow the oil to "clean" itself. Continously turning the pump on and off will only serve to promote oxidation of the pump oil.

The turbomolecular pump, as with the roughing pump, is affected by mechanical wear. Therefore the number of starts and stops will have a definite effect on bearing life and should be kept at a minimum.

(NOTE: The previous discussion on diffusion pumps relates to oil diffusion pumps, and not mercury diffusion pumps.)

GLOSSARY

By Mark A. Snyder

Backstreaming — is when gases of vapors present in a vaccuum system move through the system in the opposite direction form the vaccuum pump. Backstreaming of a gas or vapor is largely dependant on the vapor pressure of the substance in question.

Bombarder flashback — is when the bombarding transformer creates a heavy glow discharge back through the vacuum manifold and to the roughing pump instead of through the neon unit being processed.

Cold trap — is a device that surrounds a section of manifold and/or pump and is filled with a very cold substance such as liquid nitrogen (-196 C). However, dry ice and alcohol are sometimes used. Cold traps are usually placed between the secondary vaccuum pump and the system being pumped to prevent the back migration (backstreaming) of gas and vapor into the system by cold condensing.

De-gas (de-gassing) — is the removal of gases and vapors from a material by heating the material in a vacuum. In the case of the neon tube, the glass, fluorescent powders and electrodes are de-gassed by internal bombardment.

Diffusion pump — is a secondary vacuum pump that heats an extremely low-vapor-pressure fluid (usually silicone oil) to the boiling point (under vacuum), to produce vapor. The high density oil vapor diffuses through a jet toward the roughing pump and impacts gas molecules that enter the diffusion pump through natural diffusion (hence the name), and push them on to the roughing pump. To operate it requires a priming vacuum, provided by a roughing pump.

Fractionation — is the separation (by the vapor jet assembly) of desirable and undesirable oil-vapor fractions, due to decomposition of the oil over time.

Free air displacement — is the volume of air per unit/time that can be displaced by a pump (usually a roughing pump) when the intake and exhaust of the pump are atmospheric pressure. It is usually expressed in liters per minute (L/min.) or cubic feet per minute (CFM).

Hard vacuum — is a decreasing pressure obtained by a vacuum pump(s) operating at maximum performance, against a work load in an attempt to achieve its ultimate vacuum.

Hg. — is the chemical abbreviation for mercury (quicksilver)

High vacuum — is the vacuum range between 10^{-3} to 10^{-6} torr (1 to 0.001 micron) set forth by the standards committee of the American Vacuum Society.

Mean free path — is the average distance traveled by a molecule between molecular collisions. At 10^{-3} (1 micron) the mean free path is five centimeters. At 10^{-9} (0.000001 micron) the mean free path is over 30 miles! However, the molecular path is limited more by the walls of the conduit than by the number of molecules in the system.

Medium vacuum — is the vacuum range between 1 torr and 10^{-3} torr (1mm to 1 micron).

Micron — is a unit of measurement of length equal to 1/1,000 of a millimeter. In vacuum work it is sometimes expressed as 10^{-3} torr and relates to the change in height of a column of mercury (mercury manometer).

Millitorr — is a unit of pressure-measurement equal to 10^{-3} torr. It is the same thing as a micron and is a finer gradation of the torr scale.

Molecular flow — is the random flight of gas molecules in a vacuum chamber and typically occurs at 10^{-3} torr.

Molecular permeation — is when a material is exposed to atmospheric pressure on one side and high vacuum on the other side and atmospheric air actually penetrates the material, permeates through the material and is released on the vacuum side of the material. It is usually the result of using inferior materials that are not compatible with high-vacuum use. It can be experienced with stopcock grease as well as O-ring connections but is especially troublesome with rubber hose connections.

Molecular velocity — is 1100 miles per hour (96,798 feet per second) and is achieved in the high-vacuum range and below.

Molecule — the smallest particle that can be identified as a gas in its natural state.

Out-gas (out-gassing) — is the desorption of gas from a material in a vacuum. This is one of the most misunderstood phenomenons in vacuum work, especially in relation to neon tube processing.

Pressure — A perfect vacuum (called absolute vacuum), which would be the total and complete absence of all molecules, has never been achieved. Even at a vacuum level of 10^{-9} torr there are 40 million molecules per cubic centimeter. When a molecule hits something it exerts a force or pressure against it. If even one molecule is present it is considered a positive pressure. The amount of molecules determines the amount of pressure. Therefore, pressure is the presence of gas molecules and vacuum measurement is actually pressure measurement.

Pumping speed — is volume per unit time. It is usually expressed in liters per second (L/sec.), liters per minute (L/min.), or cubic feet per minute (CFM).

Roughing pump — is a mechanical piece of equipment that is designed to reduce the pressure inside a sealed chamber, and hold that pressure at or below a certain level in order for a secondary vacuum pump to operate. Other names for a roughing pump are: fore pump, mechanical pump, rotary pump or vane pump.

Rough vacuum — is the vacuum range between atmosphere and 1 torr (760mm to 1mm).

Secondary vacuum pump — is a pump that is designed to work in conjunction with a roughing pump, and in fact requires a priming vacuum to operate. They produce higher speeds and achieve lower pressures than a roughing pump alone can obtain. There are many different types of secondary pumps.

Throughput — is the pumping speed times the pressure, or quantity of gas flow. Maximum throughput is usually expressed relative to a pump and is the pump's maximum gas transfer capability, and is generally presented as torr liters per second (torr L/sec.).

Torr — is a measurement of pressure. One torr equals one millimeter of Hg. column. The torr scale was devised by torricelli, a student of Galileo.

Turbomolecular pump — is a secondary vacuum pump that has several (usually 10 to 15) high-speed rotating turbine blades (hence the name). It operates by the rotating blade hitting a gas molecule and forcing it through the pump. As with any secondary vacuum pump it requires a priming vacuum provided by a roughing pump.

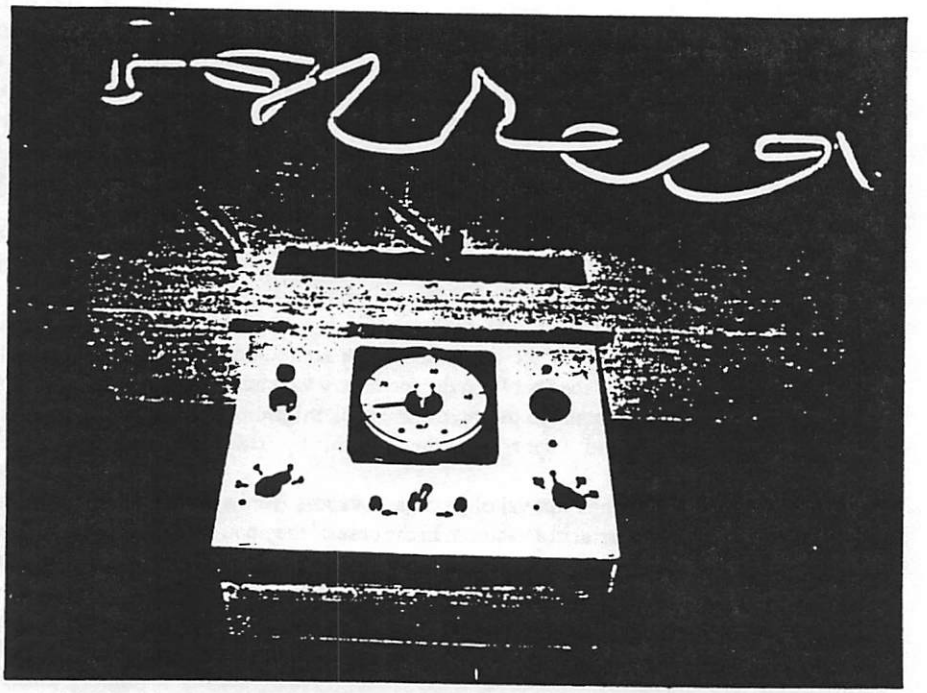
Ultimate vacuum — is the best vacuum obtainable with a vacuum pump and/or a vacuum system free of leaks, under controlled conditions, after 24 hours of continuous pumping. It is sometimes referred to as ultimate pressure.

Vapor pressure — is the pressure at which a substance will evaporate or release gases at a given temperature. Example: The vapor pressure of mercury is 1.9 microns (approximately 10^{-3} torr) at 20° celcius (68° F). In other words, at room temperature once the vacuum approaches 10^{-3} torr any mercury in the system will start to vaporize.

Viscous flow — is the direct movement of air through a duct or conduit in a specific direction, and is not random but deliberate. It occurs in the pressure range between atmosphere and 10^{-3} torr.

Neon Projects' Select-O-Former

By Larry Kanter
Neon Projects, Washington, D.C.



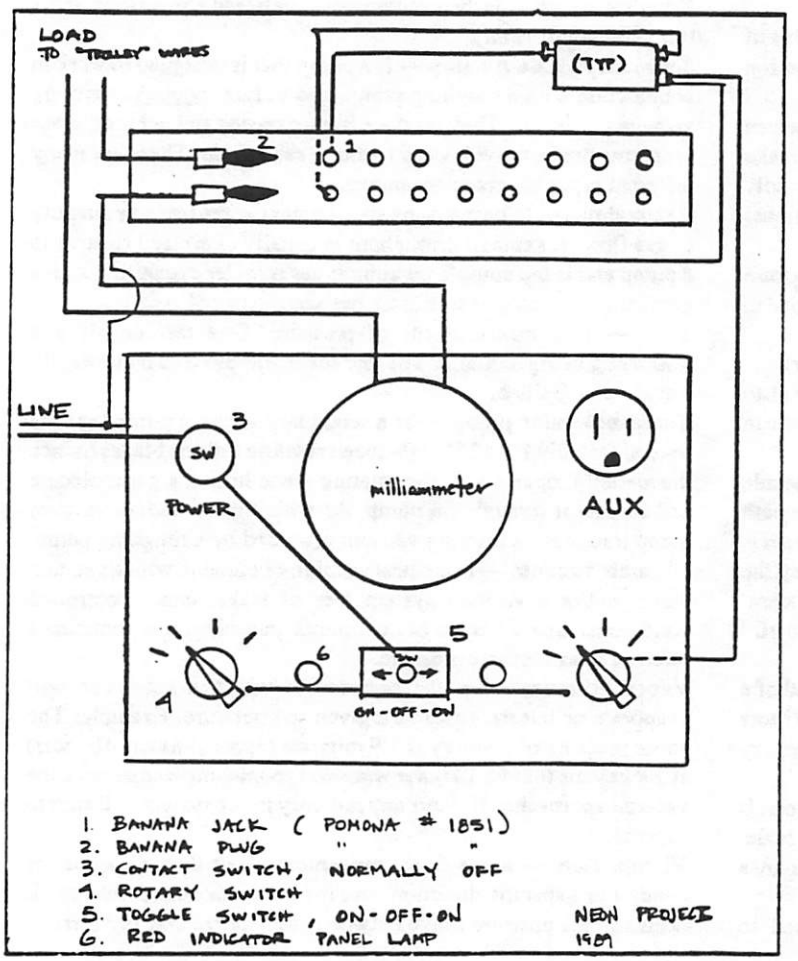
Sizing the right transformer for a job using the milliammeter can be a tedious job — all those alligator clips and clutter of wires and transformers on the table. And who among us hasn't been zapped a couple of times in the process?

We've eliminated these problems in our shop with our un-patented Select-O-Former, with $30 of parts and a day's work to put them together.

The unit is nothing more than a switching device to very quickly run any transformer through the milliammeter. All you do is switch the line power to the selected transformer, then switch the high-voltage wires from that transformer to the tubes via the milliammeter.

We first put all the most common sizes of transformers on a shelf under the table. Then we built a pair of overhead "trolley" wires to hook up to the tubes.

To get the 120v power to the selected transformer we have two rotary switches, and an on-off-on toggle to select which rotary is powered. (This is because we couldn't find an 8-position rotary, and so we used two 4's.) A contact switch, normally off type, is pressed to power-up.



To switch the high-voltage leads we built a panel with a double row of "banana" jacks, which are fed from the two high-voltage posts of each transformer. One jack (female part) is then manually hooked by a banana plug (male part) through the milliammeter and then on up to one trolley wire; the other jack fed by each transformer is plugged into and feeds directly up to the other trolley wire.

Don't make the mistake we made and buy double (Siamese twin) type banana jacks and plugs. These are too close together for high-voltage work and will arc to each other! Buy singles instead, and mount them on a non-conductive panel with at least 1" clearance. (For banana jacks and plugs we used Pomona #1851.)

Operation is a quick two-step: move the two banana plugs to the jacks of the desired transformer, then dial the power to that transformer and hit the switch. You can run through eight transformers in under a minute, and have time to touch up your blockout!

One convenient addition to the design is an auxiliary power outlet for the odd-sized transformers that you don't want to have permanently hooked up. We use this for the occasional 20ma or 60ma units.

Also, you can put a variac transformer and voltmeter on the line in, but this really helps only if you have first tested the true voltage at the installation site.

So build it yourself

If you want to play around with your own "plasma ball" - type neon power source, Radio Electronics magazine's March 1988 issue (found in most libraries) has an article on how to build these.

They also list the supplier of kits for these: Information Unlimited, P.O. Box 716, Amherst, NH 03031. The kits are $59.50. The "flyback"-type transformer, a hard part to find, can also be bought seperately for $29.50.

These units can be used on regular neon tubes as well as single-electrode-type tubes, and can create "writing" effects. They can also be hooked up with a radio or audio input and will pulse accordingly.

The flyback-type transformer is also commonly found in televisions — does anyone out there know how to convert one of those for this kind of use?

Another gem of technical misinformation, courtesy of a wire news story that reached millions of readers across America this spring:

"Discovered in France in 1912, electrical neon is the generally accepted name for the five inert gases used in the craft. Artisans sketch a design on heat-resistant cloth, hold the hollow glass rods before a gas jet and bend them to fit the pattern. Electrodes are soldered onto each end of the sign. Blinking signs get a transformer as well, which cuts the current on and off."

— Stephen Robitaille, Knight-Ridder News Service

Promises, promises

If you want to share star billing in our next few issues, send in your ideas, experiences and/or questions by the end of September on the following subjects (or any others):

NEON HEALTH AND SAFETY — a cautionary tale on eye care, a plain-English list of warnings and instructions for your customers, toxic chemicals to watch out for, tips on child-proofing (and pet-proofing) shops, and information on OSHA rules and the high-voltage controversy...

THEATER MARQUEES AND OTHER HISTORIC RESTORATIONS — technical hints and controversies; how to find and use special libraries, permit offices and other sources for information about old buildings' original appearance; getting funding, publicity and political support for restorations; tales of specific restorations in Minnesota, Hawaii and elsewhere...

PHOTOGRAPHING NEON: technical hints from a professional photographer, flip books as sales tools, readers' photo collections, maybe even the start of a neon photo exchange or lending library...

A TOUR OF A GLASS FACTORY

A NEON KITE: yes, it flies as it glows

NEON TRAVELS: Hong Kong, Vegas, El Camino Real and other pilgrimage sites (send us lists of your favorite hometown signs)

NEW MARKETS FOR NON-SIGNAGE NEON: architects, interior designers and wholesale furnishings showrooms

SIGN CODES: making friends and influencing people who think they hate neon with low-key, stereotype-busting presentations

(Augusta, from page 1)

within the last ten years.

They should have a slightly above-average IQ, they should physically look good and know how to present themselves in public, they should not be in class because of their psychiatrist's request that they do something with their hands.

They should not be engineers, lawyers, dentists (although dentists have to work with their hands so you can let them in), but math, english, sociology, psychology, in fact all social science instructors, no, they should have the hands of Matisse, the savvy of Andy Warhol, and the looks of Kim Basinger; then they could learn something from you.

And you might learn from them. That's when teaching is the best: when students and teacher are learning. And that's the truth.

That reminds me of the first time I was in L.A. in the summer of '86. I went to an art school downtown that shall go unnamed, and thought I had died and gone to Neon Hell!

There was a show of neon art going on that looked like a slightly fey version of all the L.A. neon artists' work. It was slightly off, like being in Canada without knowing it.

There was a piece on the wall that looked like Lili Lakich's work: the diamond plate, the brushed aluminum, the "crackle tube," the big, rather dumb gesture of the piece in its entirety, yet it was even more dull than Lili's work.

There was a floor piece that had many geometric tubes, flashing on and off in some sort of sequence in some kind of architectural plastic box. It was a clone of Eric Zimmerman's work! Which to me has always been full of sound and fury but unfortunately signifying nothing...

And another piece had a simple curve repeated over and over in different colors and in sequence so there appeared to be movement through space! Michael Hayden? No. Even though he's had phenomenal success in work after work proving that if you repeat a trite idea enough times it begins to acquire a kind of meaning: Minimalism and Buddhism and Mrs. Sanguedolce prove this out. (Mrs. Sanguedolce? (Italian: sweetblood.) She was my third grade teacher who made me write on the blackboard 100 times: "I will not spit on girls." Well, I don't do it anymore.)

There was a small piece on a pedestal that looked like a Larry Albright, but wasn't as clean as his work; sort of a Larry Halfbright.

And so on. Piece after piece wrong. Finally I had to ask the receptionist what I was looking at. She replied: "This is the group show for the neon design class!"

What torture to put these kids through, I thought; and just to copy marginal work at best.

So beware. You almost can't teach neon; the medium is too pretty and people like it for wrong reasons.

It's like trying to give a lecture when you have a gorgeous blonde in the first row with a short skirt who keeps crossing and uncrossing her legs!

To learn neon you have to learn to ignore her! And still continue to function!

In a false light: "neon" and non-, on and on

By Val Crawford

Neon is booming, trendy, profitable, revived and generally doing all right after decades of neglect and plastic signage. Neon is even newsworthy, with feature stories, new applications and galleries springing up all over. So what's the problem?

The problem is word thieves who have grabbed "neon" for applications that have nothing to do with the real thing. From colors to trends to clothing to typefaces to slasher movies to McDonald's promotions to my cereal box this morning — seems like everyone has picked up the word "neon" and used it to sell their own stuff. I know I'm especially hyper about it because I work with words, but I feel that, Dracula-like, they're sucking the word dry by depriving it of any meaning, and then embalming it with the garish connotations of their own products.

Some examples:

I walk into the gift shop of a major science museum, and see so-called "neon clocks" made of flourescent optic fiber and black lights. I ask the cashier why they are incorrectly advertising these as neon; she shrugs, doesn't know the difference, doesn't care even when she hears it explained.

A coming detraction

Now playing at your local video parlor: "NEON MANIACS" (released by Lightning Video, no less). This title caught our eye, and the box-blurb was so offensive that we thought we'd share it with you:

"'Slash.' 'Mohawk.' 'Hangman.' 'Thing.' 'Samurai.'

"They're the NEON MANIACS — an unstoppable, hideous incarnation of evil zombies terrorizing the residents of San Francisco. 'Neon,' because they can only be seen in the dark; 'maniacs,' because they kill at will!

"Living deep inside the Golden Gate Bridge, the NEON MANIACS take to the streets under the veil of darkness ...NEON MANIACS — just add water for edge of your seat suspense and terror!"

The "science" museum charges $200 for these misleading and tacky items, and keeps it all — courtesy of its tax deduction for charitably educating the masses about the high-tech wonders of physics and electronics!

Then there's the quaint anachronism of using "neon" to mean racy, garish, sinister, nocturnal — as in the grade-B video "Neon Maniacs" (elsewhere on this page) which has exactly nothing to do with neon. It's a money-making throwback to neon's venerable past associations with risky business, vice and low-rent nightlife; funny how that image still sticks despite the proliferation of upscale pastel-neon-lit nightspots and the miles of clean-cut yuppie mall signage that fill our pockets these days. Do we have the blinding neon of check-cashing joints to thank for the revival of the neon-equals-tacky equation? Now THERE'S a good place for the criminal crowd to pick out victims by ominous red and blue light...

Yet the true-blue and unmistakable red-orange of common sign neon aren't even the "neon" colors that sell a thousand other products these days. What we used to call Day-Glo orange and lime green seem to be the leaders on T-shirts, swimsuits, sunglasses and store displays, with some electric pinks and a darker-than-mercury blue completing the pathetic pallette. Makes me want to grab a pen, the phone or the nearest salesperson's elbow to ask "Why do you call it 'neon'?" Maybe I can use the occasion to blackmail someone into ordering some store-window neon, after all...

So, comrades, let's be ready to counter people's misconceptions and stereotypes with a clear definition and a few well-chosen examples of the real thing, either by citing a beloved local example or whipping out wallet photos. After all, WE know neon is anything but a gray area...

(At this point Ted, of course, butts in and says "What about all those argon-and-mercury luminous tubes that everyone calls 'neon'?")

(Hot seat, from page 3)

every place that had broken, that was close to metal, would arc out through. I took all kinds of pictures.

He took them to court, and I had to go in there and testify. That was kind of tough, first of all for me because I only had less than a year of experience, for one thing, and also because my father knew the ... family that owned the sign company really well, and it was kind of like a conflict of interest for me.

Even though I couldn't stand them myself, I thought they were all pigs and assholes — I mean, you know, they do the worst work, just the absolute — I don't care whose friends they are, and I told my father that. I said "Look. They might be friends of yours, but they do crappy work and they give the rest of us a bad name. That's the way I feel, and if you don't like it, tough shit."

So I went anyway, and the restaurant owner won. And the judge said "Well, I don't really think..." and he looked at me and said, "No offense to your expertise in the field, but I think these pictures pretty much say — I mean, I'm not an electrician but I can see that this is a pretty crappy job..." It was so obvious!

I was glad, but I was kind of nervous about the whole thing. The guy that owns the sign shop weighs like 350 pounds, and his sons are bigger than he is, and I'm kind of waiting for my windows to get bashed in, but it never happened, and <the owner> got his money back. And then he hired me to do the whole thing over. We literally threw everything, right down to the tube supports, we threw right out.

So I was happy with it, and he was happy with it, and it's been up ever since, and I go every April and clean off the tubes with Windex. That's about it.

Installers get the last word...

...Any questions?

By Audie Foote

In the past I've made statements to the effect that you had to be at least somewhat weird to make neon for a living. This weirdness is even apparent in what we have people call us, namely "benders" and "blowers." Sorry, I personally refuse to call myself that. Nope, not this guy. And I'm not a "gas jockey" either.

But I've found (to my dismay) that it's not so easy to shake an acquired label. Recently my Aunt Helen asked me what I do for a living. "Well," I said smugly, "I'm into 'silicate engineering.'" "Ooooh-h-h," she sighed, sounding duly impressed, "That's wonderful. So tell me, do you like being a 'tubebender'?"

Anyway, I'm telling you this because I've found a profession that makes us "shaft-crafters" look almost normal by comparison. I'm referring to that unenviable group of full-tilt wackos whose lot in life is to INSTALL neon for a living. I know, this sounds a little like the bar drunk who says "I don't have a drinking problem, but you see that guy over there? Now HE's got a drinking problem." I don't mean to say that you have to be out of your mind to install neon, but it helps.

Two grown men were on the floor, howling at my painful misfortune. (I will admit that I screamed like Roger Rabbit.)

Over the years I have turned my precious tubes over to some real strange people for installation. It's kind of like entrusting your firstborn to some nanny who you hope doesn't turn out to be a member of a satanic cult. Nobody realizes more than I do how an installer can make or (excuse this) break a neon job. God bless the good ones. The others? Well, for example, when Norman Bates wasn't taking care of his mother's motel, he was a part-time installer with his own boom truck. Freddy Krugger, another former installer, was said to have "great hands for glass." You get the idea: some of them are really bizarre people.

What made me suddenly come to this realization? Simple: I WENT OUT ON AN INSTALLATION. I spent three of the worst days of my life at the Honolulu airport climbing up and down a shaky ladder carrying big, wobbly sections of neon through "gentle Hawaiian tradewinds" of up to 60 mph in 90-degree heat, facing sunlight off a white wall that fried my eyes like two eggs. Oh, and did I mention the sonic booms from the F-16 Phantom jet attack exercises nearby?

I was a nervous wreck even before some sadist "inadvertently" pulled the switch while I was touching live wires, thereby sending 12,000 volts boogalooing through my body with enough force to fuse my dental work together at the silver fillings.

And you know what happened then? My fellow installers (this is what makes them weird, folks) broke up laughing. Two grown men were on the floor howling at my painful misfortune. "You shoulda seen the look on your face, HO-HO." "You shoulda heard what you sounded like." (I will admit that I screamed like Roger Rabbit or a victim in a bad werewolf movie.)

But then these guys went on to laugh about other near-electrocutions they'd been party to. "Hey, remember when you were on that ladder and you touched that exposed wire with your shoulder and 15,000 volts arced through your knee into the wall?" "Yeah, and my hair and pants were on fire and it smelled like someone was having a barbecue?"

Hysterical, isn't it?

Dean Blazek, who taught me neon a decade ago, demonstrated what he called "the installer's test" wherein he would drop a student's glass masterpiece onto the worktable from a height of eighteen inches or so. This, we were quick to learn, showed where the bad bends or welds were, as well as showing us what our friends the installers would be doing to our work in the future.

Then he'd say, "Any questions?" Nope.

But I've never met an installer yet who has broken a single piece of neon — none that he'd admit to anyway. The other day one of my installers, who we'll call Irwin, came in with four broken units:

ME: FOUR broken pieces? You broke FOUR pieces of my neon?

IRWIN: Not me, I didn't break them. You know I don't break neon.

ME: Well, what happened to it then?

IRWIN: Beats me.

ME: Yeah, I'd like to.

IRWIN: What?

ME: Oh, nothing.

The closest thing to an admission of guilt I've ever gotten was this call:

IRWIN: Boss, can you make me another four-foot "B"?

ME: Why? What happened to the one I made?

IRWIN: I think the gas musta leaked out.

ME: Oh, just bring it back then and I'll repump it.

IRWIN: Uh, I don't think that's practical.

ME: Why not? ...Say, exactly how did it lose its gas?

IRWIN: Well, it musta been right at the end of that two-story fall from the roof we was on.

ANY QUESTIONS?

CLASSIFIED ADS

NEON SIGN COLOR POSTCARDS: Buster Brown, Mobilgas Flying Horse, Simple Simon, etc. Fifty cards for $13.50. Davidson, 860 North 26th Street, Philadelphia, PA 19130. (215) 232-0478.

SMALL BUSINESS FOR SALE — Sunny So. CA. Successful and well established. Two station NEON plant w/ complete bombarding facility, completely stocked inventory and busy retail showroom. Priced for quick turn-key sale. Owner relocating. NEON DIRECT, Culver City, CA (213) 836-9844.

BULLETIN BOARD

Daniel Dezort of Sacramento, CA, writes: "I built a pink neon sign that actually said `neon' and powered it by using the schematic in volume I, number I. I put it under the camper shell on my pickup and drove to the local CHP office to find out how illegal it was. When I stepped on the brakes or turned on the left turn signal it would light.

"As it turns out the desk sargent said it was just a little illegal — isn't that like a little pregnant? `Not approved S.A.E. equipment' and `not the right color.' It has to be red not pink. Thought I'd let you know."

Someone taped this **Lenny Bruce** quote to Val's desk at work:
"Miami Beach is where neon goes to die."

MISSING SUBSCRIBERS

The following people have had their newsletters returned — anybody know a current address?

Light Tec Neon and Lighting/David Wiles, Eugene, Oregon

James Winters, Miami Beach, Florida

Jim McIntyre, Kaneohe, Hawaii

Of sympathy, spiders and "crapoli repairs"

I have to take a break from the crapoli repairs I'm working on. You know the kind: the motel neon they told you just got broke by the nasty little kids in the neighborhood. Yeah, right — the bottom part of the "TEL" is full of water and the top part has got so many spider webs in it, the water won't come out.

And all those little critters in there — I feel sorry for them. Usually I try to save them. After reading "Charlotte's Web" in 2nd grade, I developed an affection for them. I open up the back door of my shop and lay the unit on the grass and tap it a time or two, and they usually crawl right out.

Today I had no sympathy. On the dry units, I just put new 'trodes on and nuked the little bastards on the bombarder. Christ, the animal activists would probably picket my place it they knew.

Well, they didn't suffer.

--Nancy Hannmann

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